



## The first record of the bark louse genus *Symbiopsocus* (Psocodea: Psocidae) from Vietnam, with description of a new species

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### Abstract

The bark louse genus *Symbiopsocus* includes 23 species, all of which known from East Asia. Here we report the first record of *Symbiopsocus* from Vietnam, with description of *Symbiopsocus vietnamicus* sp. nov. A revised key to the species of *Symbiopsocus* is provided.

**Key words:** Psocomorpha, Psocinae, taxonomy, Indochina

### Introduction

The bark louse genus *Symbiopsocus* was described by Li (1997), with the Chinese species *Symbiopsocus leptocladus* Li, 1997 as the type species. This genus is placed in the tribe Ptyctini of the subfamily Psocinae. The adults of *Symbiopsocus* are characterized as follows: wings pale yellow, immaculate in most species; male hypandrium usually symmetrical with two tiers of lobes; phallosome slender, rhomboid; female subgenital plate with V-shaped sclerotized region on posterior lobe. After the original description, 12 species were described by Li (2002, 2005), Mockford (2003), Yoshizawa (2008), and Liu *et al.* (2011, 2014). Yoshizawa & Mockford (2012) considered that *Mecampsis* Enderlein, 1925 is a genus endemic to South America and the Greater Antilles, and they placed 10 Chinese species of *Mecampsis*, i.e. *M. multimacularis* Li, 2002, *M. septangulatus* Li, 2002, *M. dolichosus* Li, 2002, *M. ophiocephalus* Li, 2002, *M. undulates* Li, 2002, *M. nanyuensis* Li, 2002, *M. latus* Li, 2002, *M. magnificus* Li, 2002, *M. unitus* Li, 2002, and *M. changbaiensis* Li, 2002, into *Symbiopsocus*. *Symbiopsocus sturmi* (Badonnel, 1986) from Colombia was transferred to *Psocomesites* Roesler, 1943 by Yoshizawa & Mockford (2012). So far, there are 23 species in *Symbiopsocus*, all from East Asia (Liu *et al.* 2011). In this paper we describe a new species of *Symbiopsocus* from northern Vietnam and provide a revised key to the species of the genus. This new species represents the first record of *Symbiopsocus* from Vietnam and from Indochina peninsula.

### Material and methods

The specimens were observed under a Nikon SMZ745 stereomicroscope, and the genitalia was observed and photographed under a Leica DM2000 microscope, with a Nikon D800 camera. The photographs of external characters, except the genitalia were taken using Keyence VHX-1000 attached with VH-Z100W. Genitalic preparations were made by clearing the apex of the abdomen with KOH in 85–100°C for 10 minutes. After rinsing the KOH with water, the apex of the abdomen was transferred to glycerin for further examination. All the specimens examined are deposited in the Entomological Museum of China Agricultural University (CAU), Beijing.

Abbreviations for body parts measured are: f1–f3, flagellomeres 1–3; d, transverse diameter of right compound eye; IO, minimum distance between compound eyes; FWL, length of forewing; FWW, width of forewing; HWL, length of hind wing; HWW, width of hind wing; t1, t2, first and second tarsomere of right hind leg.

## Taxonomy

### *Symbiopsocus* Li

*Symbiopsocus* Li, 1997: 491. Type species: *Symbiopsocus leptocladus* Li, 1997: 491 (original designation).

**Diagnosis.** Adults with well-developed wing, small to medium sized, length from post clypeus to wing tip 4–6 mm. Antenna as long as or slightly longer than forewing. Wings usually pale yellow, immaculate, but with brown markings in a few species; Sc ending free; Rs and M connected by a short crossvein or fused for a short distance or meeting at a point; M+Cu<sub>1a</sub> and first part of Cu<sub>1a</sub> together arranged as a nearly continuous, straight line; areola postica subtriangular; male hypandrium usually symmetrical and with two tiers of lobes; phallosome slender and rhomboid-shaped; female subgenital plate with V-shaped sclerotized region on posterior lobe; ventral valve slender with acutely tapering apex; dorsal valve broad with acutely tapering apex; external valve longer than wide, mostly with posterior lobe.

### Key to species of *Symbiopsocus*

#### Males

1. Hypandrium with one tier of lobes (Li 2002: Fig. 1262G) ..... 2
- Hypandrium with two or more tiers of lobes (Li 2002: Fig. 1263E) ..... 3
2. Phallosome ovoid, basally expanded (Li 2002: Fig. 1262E) ..... *diplocyclus* Li
- Phallosome long and narrow (Li 2002: Fig. 1268E–F) ..... *ternatus* (Li)
3. Hypandrium with median tongue-like structure (Yoshizawa & Mockford 2012: Fig. 2C) ..... 4
- Hypandrium without median tongue-like structure (Yoshizawa 2008: Fig. 2C) ..... 10
4. Hypandrium with median tongue-like structure divided bilaterally with narrow notch posteriorly (Yoshizawa & Mockford 2012: Fig. 2C) ..... 5
- Hypandrium with median tongue-like structure not divided bilaterally with narrow notch posteriorly (Li 2002: Fig. 1264G) ..... 6
5. Median tongue-like structure of hypandrium with a pair of processes extending from dorsal surface near base of tongue directed postero-laterally (Yoshizawa & Mockford 2012: Fig. 2C) ..... *hastatus* Mockford
- Median tongue-like structure of hypandrium without process extending from dorsal surface near base of tongue directed posterolaterally (Li 2002: Fig. 1270G) ..... *multimacularis* (Li)
6. Forewing with short spur vein (Li 2002: Figs 1271B, 1272B) ..... 7
- Forewing without spur vein ..... 8
7. Forewing Rs and M meeting at a point; phallosome long and narrow, not curved medially ..... *dolichosus* (Li)
- Forewing Rs and M connected by a crossvein; phallosome curved medially, nearly with angle of 90° (Li 2002: Fig. 1272E–F) ..... *septangulatus* (Li)
8. Hypandrium with median tongue-like structure relatively large; phallosome curved (Li 2002: Figs 1264G, 1264E–F) ..... *bicruris* (Li)
- Hypandrium with median tongue-like structure smaller; phallosome long and narrow, not curved ..... 9
9. Hypandrium with a pair of spines on bottom of ventral lobe (Liu *et al.* 2014: Fig. 5) ..... *yangminus* Liu & Liu
- Hypandrium without spines on bottom of ventral lobe ..... *ophiocephalus* (Li)
10. Hypandrium basally with fine spines (Li 2002: Fig. 1266G) ..... 11
- Hypandrium basally smooth, without spines ..... 13
11. Ventral and dorsal lobes of hypandrium covered with minute denticles (Yoshizawa 2008: Fig. 2C) ..... *formosanus* (Okamoto)
- Ventral and dorsal lobes of hypandrium smooth (Li 2002: Fig. 1266G) ..... 12
12. Hypandrium basally with five spines (Li 2002: Fig. 1266G) ..... *chaulommaus* Li
- Hypandrium basally with an area of small spines (Li 2002: Fig. 1269F) ..... *subrhombeus* Li
13. Epiproct proximally flat ..... *longicaulis* (Li)
- Epiproct proximally invaginated on each side ..... 14
14. Hypandrium asymmetrical (Li 2005: Fig. 15E) ..... *yajunae* Li
- Hypandrium symmetrical ..... 15
15. Forewing with Sc ending in Rs ..... *leptocladus* Li
- Forewing with Sc ending free in membrane ..... 16
16. Epiproct anteromedially with a short cone-shaped projection (Liu *et al.* 2011: Fig. 6) ..... 17
- Epiproct anteromedially without cone-shaped projection ..... *quadripartitus* Li
17. Hypandrium basally with sharp sclerotized region on each side (Liu *et al.* 2011: Fig. 5) ..... *furcatus* Liu & Liu
- Hypandrium basally without a sharp sclerotized region (Fig. 3D) ..... *vietnamicus* sp. nov.

## Females

1. Forewing with marginal markings and without spur vein ..... 2
- Forewing without marginal markings and with or without very short spur vein ..... 5
2. Forewing Rs and M meeting at a point; subgenital plate with egg guide pigmented apically (Li 2002: Fig. 1278F) ..... 3
- Forewing Rs and M connected by a crossvein; subgenital plate with egg guide not pigmented apically ..... 4
3. Pigmented arms of subgenital plate relatively broad (Yoshizawa & Mockford 2012: Fig. 3A) ..... *hastatus* Mockford
- Pigmented arms of subgenital plate relatively slender (Li 2002: Fig. 1278F) ..... *unitus* (Li)
4. Forewing with marginal markings from distal corner of pterostigma to areola postica (Li 2002: Fig. 1279B); pigmented arms of subgenital plate slender (Li 2002: Fig. 1279F) ..... *changbaiensis* (Li)
- Forewing with marginal markings along veins (Li 2002: Fig. 1270B); pigmented arms of subgenital plate relatively broad (Li 2002: Fig. 1270K) ..... *multimacularis* (Li)
5. Forewing with short spur vein ..... 6
- Forewing without spur vein ..... 8
6. Forewing with markings at middle of cell r5 (Li 2002: Fig. 1277B); pigmented arms of subgenital plate not curved (Li 2002: Fig. 1277F) ..... *magnificus* (Li)
- Forewing without markings at middle of cell r5; pigmented arms of subgenital plate curved ..... 7
7. Forewing Rs and M connected by a crossvein (Li 2002: Fig. 1274B); subgenital plate with egg guide not invaginated proximally neither pigmented apically (Li 2002: Fig. 1274F) ..... *undulatus* (Li)
- Forewing Rs and M fused for a distance (Li 2002: Fig. 1276B); subgenital plate with egg guide invaginated proximally and pigmented apically (Li 2002: Fig. 1276F) ..... *latus* (Li)
8. Pigmented arms of subgenital plate weak and slender, not forming a V-shaped pattern (Li 2002: Fig. 1266J) ..... *chaulommaus* Li
- Pigmented arms of subgenital plate forming a V-shaped pattern at terminal ends ..... 9
9. Forewing Rs and M meeting at one point or fused for a distance ..... 10
- Forewing Rs and M connected by a crossvein ..... 12
10. External valve without posterior lobe (Fig. 4C) ..... *vietnamicus* sp. nov.
- External valve with posterior lobe (Li 2002: Fig. 1263F) ..... 11
11. Forewing with Sc ending in Rs, first section of Cu<sub>1a</sub> longer than second section (Li 2002: Fig. 1276A) ..... *leptocladus* Li
- Forewing with Sc ending free in membrane, first and second sections of Cu<sub>1a</sub> of equal length (Liu *et al.* 2011: Fig. 1) ..... *furcatus* Liu & Liu
12. Pigmented arms extending to posterior margin of subgenital plate, egg guide not pigmented apically (Li 2002: Fig. 1275E) ..... *nanyuensis* (Li)
- Pigmented arms extending to posterior margin of subgenital plate, egg guide pigmented apically (Liu *et al.* 2014: Fig. 8) ..... *yangminus* Liu & Liu

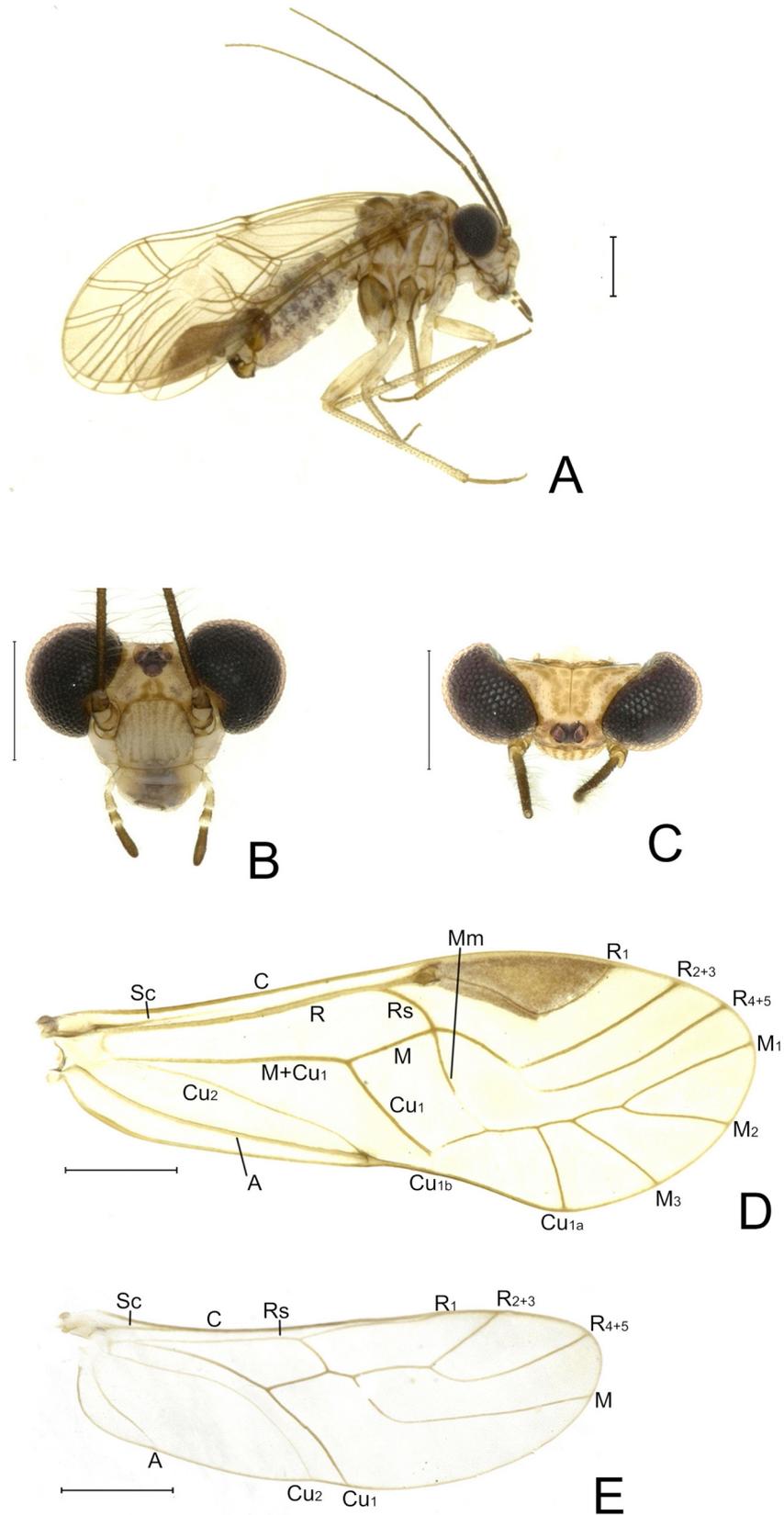
## *Symbiopsocus vietnamicus* sp. nov.

(Figs 1–4)

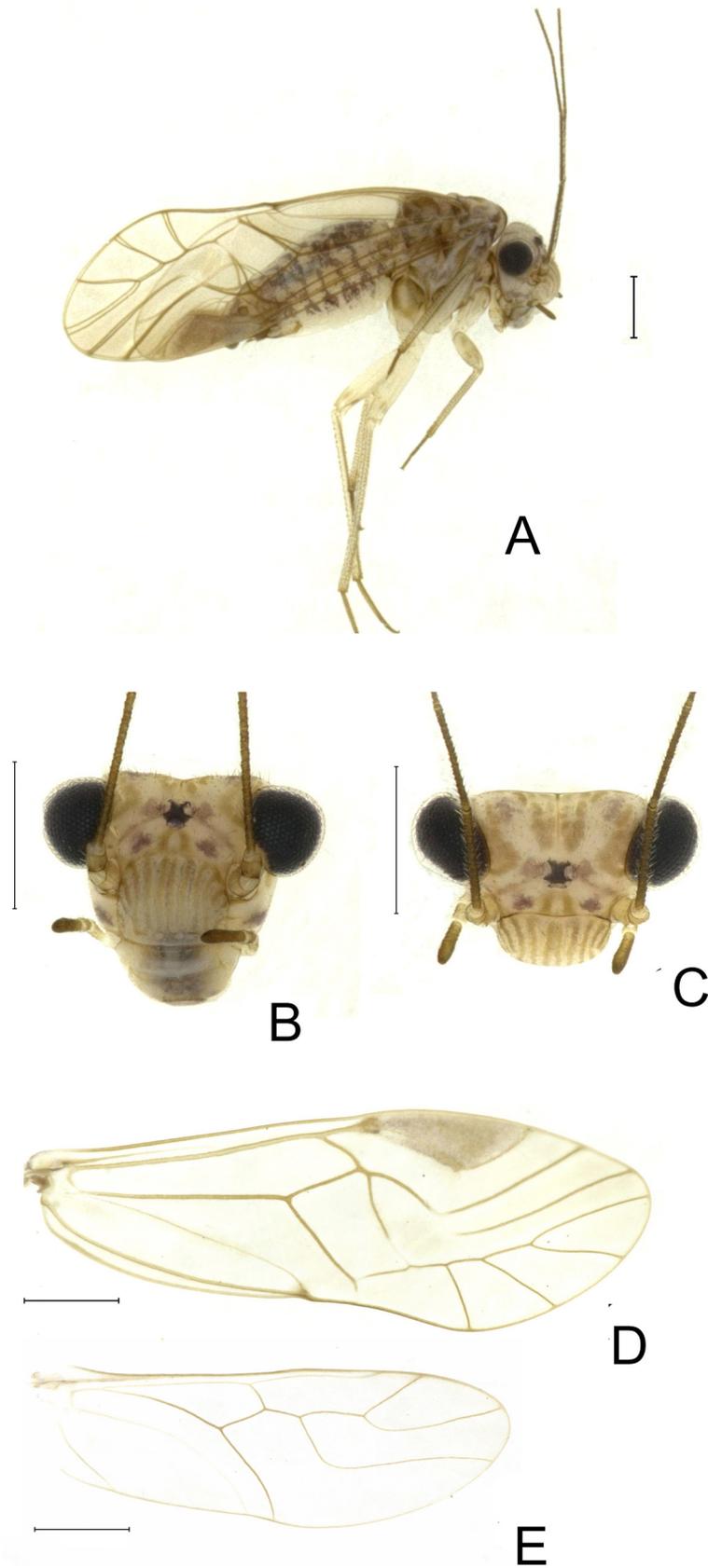
**Diagnosis.** Male paraproct medially with a short scabrous lobe near trichobothrial field. Male hypandrium: dorsal lobe with lateral arm strongly protruding posteriad and with postero-medial region distinctly protruding, forming a pair of boot-shaped processes; ventral lobe lacking denticles, largely divided in two symmetrical parts, distally flattened and with a digitiform, acutely pointed process. Female external valve without posterior lobe.

**Description.** Male. Measurements. Body length 2.49 mm, length from post clypeus to wing tip 4.01 mm. IO: 0.26 mm, d: 0.36 mm, IO/d=0.72, f1: 0.76 mm, f2: 0.66 mm, f3: 0.51 mm, FWL: 3.21 mm, FWW: 1.19 mm, HWL: 2.40 mm, HWW: 0.80 mm, t1: 0.40 mm, t2: 0.12 mm.

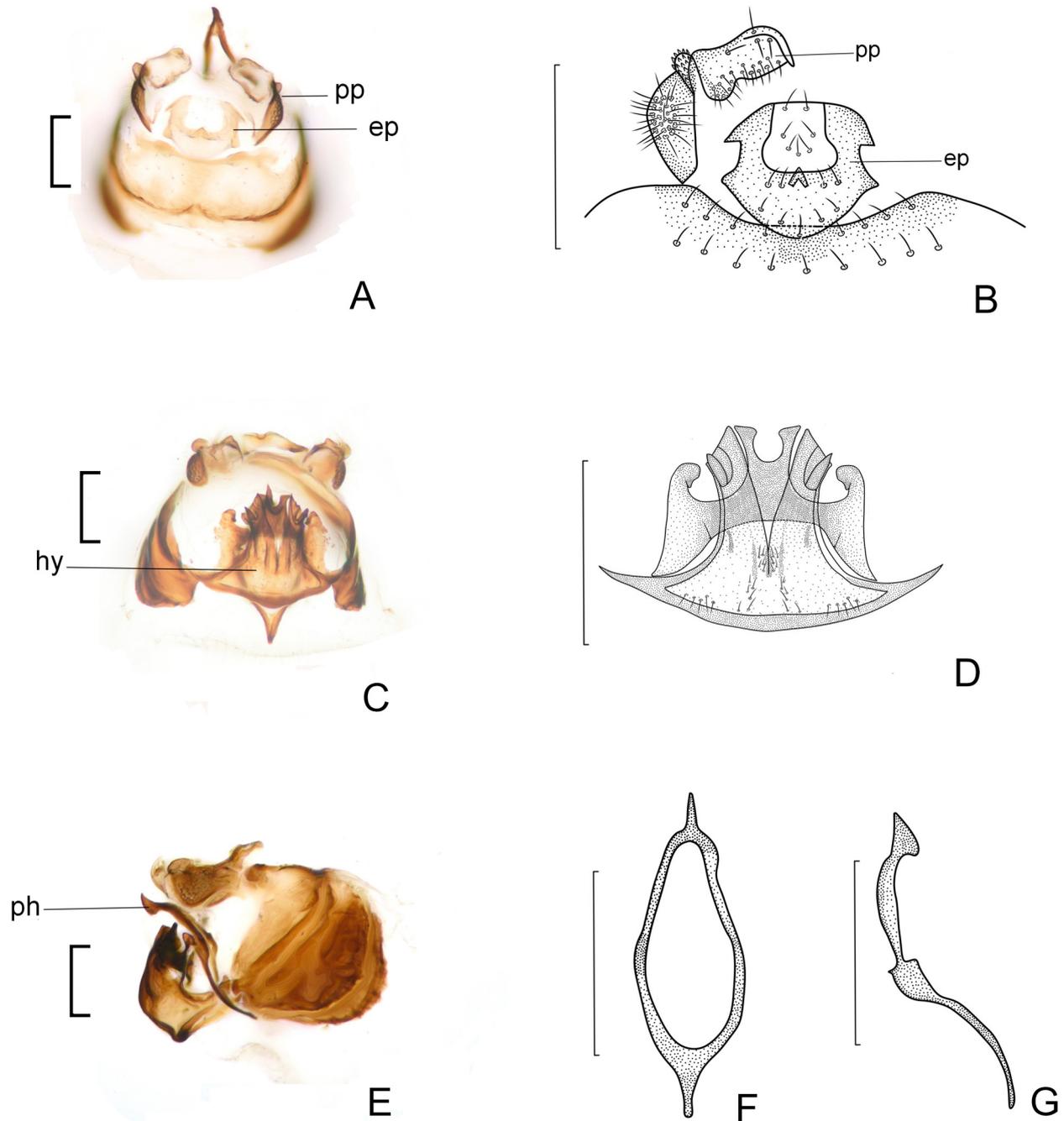
Coloration (in 95% alcohol). Head (Figs 1B–C) yellow; vertex posteriorly with brownish stripes, which medially extend along ecdysial suture, and laterally extend along inner ocular margin; a dark brown marking present at ocellar region; frons with a U-shaped brownish marking from median ocellus to epistomal suture, and laterally with a pair of small brown markings; postclypeus with eleven longitudinal brownish stripes, anteclypeus yellow laterally and brown medially. Antennae dark brown. Compound eyes black. Mouthparts yellow, but labrum medially brown and terminal segment of maxillary palps dark brown. Thorax brown, but laterally pale yellow along some sutures between thoracic sclerites. Legs pale yellow, but meso- and metacoxae brown, all tibiae pale yellow, with brown setae, entire tarsi pale brown. Forewing (Fig. 1D) hyaline, indistinctly smoky brown, with a small brown marking at distal end of vein Cu<sub>2</sub>; pterostigma brown; veins brown, but bases of R<sub>2+3</sub> and R<sub>4+5</sub> as well as distal ends of Mm and Cu<sub>1b</sub> white. Hind wing (Fig. 1E) hyaline, veins brown with Cu<sub>2</sub> white. Abdomen pale yellow, pregenital segments dorsally with a black marking, genital segments brown.



**FIGURE 1.** *Symbiopsocus vietnamicus* sp. nov., holotype male. A. Habitus, lateral view; B. Head, frontal view; C. Head, dorsal view; D. Forewing; E. Hind wing. Scale bar = 0.5 mm.



**FIGURE 2.** *Symbiopsocus vietnamicus* **sp. nov.**, paratype female. A. Habitus, lateral view; B. Head, frontal view; C. Head, dorsal view; D. Forewing; E. Hind wing. Scale bar = 0.5 mm.



**FIGURE 3.** *Symbiopsocus vietnamicus* sp. nov., paratype male. A–B. Epiproct and paraproct; C–D. Hypandrium; E. Genitalia, lateral view; F: Phallosome, ventral view; G: Phallosome, lateral view. ep: epiproct; pp: paraproct, hy: hypandrium, ph: phallosome. Scale bar = 0.2 mm.

**Morphology.** Head (Figs 1B–C) inverted trapezoidal; compound eyes large, ovoid. Forewing (Fig. 1B) membranous, glabrous; Sc ending free in the membrane, Rs and M fused for a short distance or meeting at a point, radial fork with branches diverging at an angle less than 90°; discoidal cell nearly rectangular; M+Cu<sub>1a</sub> and first part of Cu<sub>1a</sub> together arranged as a nearly continuous, straight line; Cu<sub>1b</sub> short; areola postica subtrapeziform. Genitalia (Fig. 3): Epiproct (Figs 3A–B) nearly circular, sclerotized anteriorly and laterally, antero-laterally and postero-laterally respectively with a pair of subtriangular projections, and antero-medially with a short cone-shaped projection. Paraproct (Figs 3A–B) medially with a scabrous lobe distad trichobothrial field. Phallosome (Figs 3E–G) slender and rhomboid-shaped, anteriorly protruding into a slender digitiform process, posteriorly protruding into a laterally

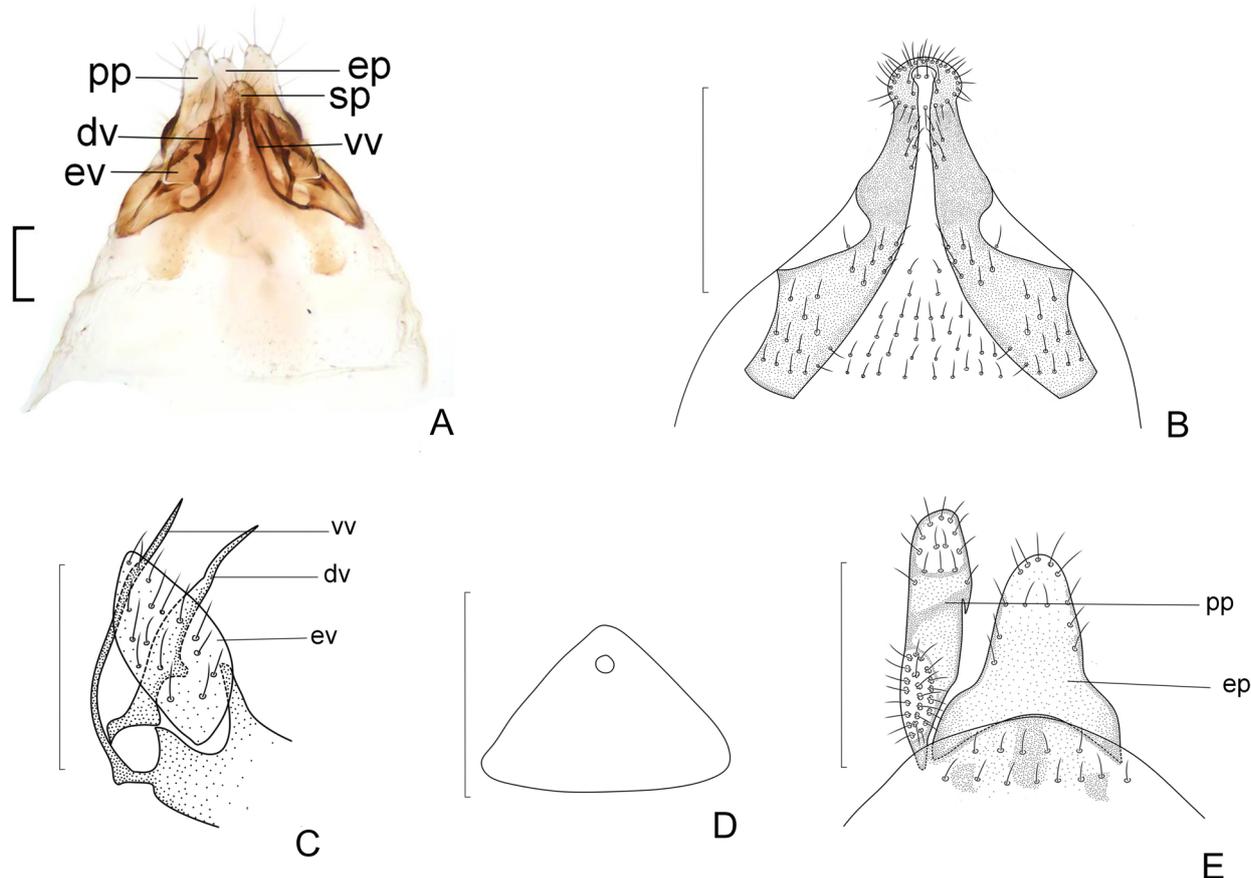
flattened, subtriangular process. Hypandrium (Figs 3C–D) strongly sclerotized, composed of two tiers of lobes; dorsal lobe gradually widened into a pair of lateral arms, distinctly protruding anterior and posterior, with sclerotization gradually weakened, and with a projection at tip of anterior protrusions; postero-medial region of dorsal lobe distinctly protruding, forming a pair of boot-shaped processes; ventral lobe lacking denticles, largely divided in two symmetrical parts, distally flattened and with a digitiform, acutely pointed process.

Female. Measurements. Body length 2.74 mm, length from postclypeus to wing tip 4.06 mm. IO: 0.46 mm, d: 0.25 mm, IO/d=1.84, f1: 0.72 mm, f2: 0.65 mm, f3: 0.49 mm, FWL: 3.36 mm, FWW: 1.18 mm, HWL: 2.48 mm, HWW: 0.82 mm, t1:0.31 mm, t2: 0.09 mm.

Coloration (in 95% alcohol). Similar to male.

Morphology. Cephalic characters largely similar to the male except for small compound eyes (Figs 2B–C). Wings similar to the male. Genitalia (Fig. 4): Subgenital plate (Fig. 4B), egg guide long, strongly sclerotized marginally and terminally round with long setae; ventral valve (Fig. 4C) strongly sclerotized, slender, elongate, acutely tapering at tip; dorsal valve broad with slender distal process, dorsal part strongly sclerotized; external valve near rugby football shape with long setae, lacking posterior lobe.

**Type material.** Holotype male, **VIETNAM:** Vinh Phuc Province, Tam Dao [21°23'N, 105°38'E], 21.VI.2011, Wang Guoquan, light trap (CAU). Paratypes: 13 males, 28 females, same collecting site, 20/21/23.VI.2011, Wang Guoquan, light trap (CAU).



**FIGURE 4.** *Symbiopsocus vietnamicus* sp. nov., paratype female. A. Genitalia, ventral view; B. Subgenital plate; C. Gonapophyses; D. Internal plate; E. Epiproct and paraproct. sp: subgenital plate; ep: epiproct; pp: paraproct; vv: ventral valve; dv: dorsal valve; ev: external valve. Scale bar = 0.2 mm.

**Distribution.** Vietnam (Vinh Phuc).

**Etymology.** The specific epithet “vietnamicus” refers to the country of origin of this species.

**Remarks.** This new species resembles *S. leptocladus* Li, 1997, *S. subrhombus* Li, 2002 and *S. quadripartitus* Li, 2002 in having similar configuration of the male hypandrium (e.g. dorsal lobe with lateral arms protruding posterior and with postero-medial region separated into a pair of projections, which are curved laterally at tip), it

also appears to be similar to *S. quadripartitus* Li, 2002 in having similar phallosome (i.e. anteriorly and posteriorly both distinctly protruding). The new species can be distinguished from the above species by the ventral lobe of the male hypandrium, distally flattened with a digitiform process. There are six species of *Symbiopsocus* known with only females, i.e. *S. unitus* (Li, 2002), *S. undulates* (Li, 2002), *S. nanyuensis* (Li, 1992), *S. magnificus* (Li, 2002), *S. latus* (Li, 2002) and *S. changbaiensis* (Li, 2002). The new species can be distinguished from all these species by the female external valve without posterior lobe.

## Discussion

The body coloration and marking patterns of body and wings are similar in species of *Symbiopsocus*. The male genital characters distinctly differ among species in this genus. Based on male genital characters, several assemblages of similar species are found. First, *S. vietnamicus* together with *S. leptocladus* Li, 1997, *S. quadripartitus* Li, 2002, and *S. subrhombus* Li, 2002 can be assigned to a species group as they share similar character of male hypandrium (e.g. dorsal lobe with lateral arms protruding posteriad, with postero-medial region separated into a pair of projections, curved laterally at tip). Second, *S. hastatus* Mockford, 2003 and *S. multimacularis* (Li, 2002) are closely related by sharing the epiproct with a short cone-shaped projection anteromedially and the hypandrium with median tongue-like structure divided bilaterally with narrow notch posteriorly. Third, *S. ophicephalus* (Li, 1995), *S. septangulatus* (Li, 2002), and *S. dolichosus* (Li, 1990) form a species group because the hypandrium has a median tongue-like structure, a dorsal lobe weakly sclerotized and inflated distally, and a ventral lobe with an area of denticles. Lastly, *S. bicuris* (Li, 1990) and *S. yangminus* Liu & Liu, 2014 are similar because of the hypandrium with a median tongue-like structure and a pair of spines basally. Future phylogenetic analyses are needed to clarify the interspecific relationships of *Symbiopsocus*.

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